



# UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE  
United States Patent and Trademark Office  
Address: COMMISSIONER FOR PATENTS  
P.O. Box 1450  
Alexandria, Virginia 22313-1450  
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/524,325	09/01/2005	Rodney J Allam	34875	1156
21186 7590 04/30/2008 SCHWEGMAN, LUNDBERG & WOESSNER, P.A. P.O. BOX 2938 MINNEAPOLIS, MN 55402				
EXAMINER				
LEUNG, JENNIFER A				
ART UNIT		PAPER NUMBER		
1797				
MAIL DATE		DELIVERY MODE		
04/30/2008		PAPER		

**Please find below and/or attached an Office communication concerning this application or proceeding.**

The time period for reply, if any, is set in the attached communication.

### Office Action Summary

**Application No.**

10/524,325

**Applicant(s)**

ALLAM ET AL.

**Examiner**

JENNIFER A. LEUNG

**Art Unit**

1797

**Period for Reply** -- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

- 1) ☒ Responsive to communication(s) filed on 29 February 2008 and 04 February 2008.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims**

- 4) ☒ Claim(s) 1-19, 21-25 and 27-29 is/are pending in the application.
- 4a) Of the above claim(s) 1-18 is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 19, 21-25 and 27-29 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

**Application Papers**

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 04 February 2008 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

**Priority under 35 U.S.C. § 119**

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some \* c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
  2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
  3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

**Attachment(s)**

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-849)
- 3) ☐ Information Disclosure Statement(s) (PTO/SB/08)  
Paper No(s)/Mail Date \_\_\_\_\_
- 4) ☐ Interview Summary (PTO-413)  
Paper No(s)/Mail Date \_\_\_\_\_
- 5) ☐ Notice of Informal Patent Application
- 6) ☐ Other: \_\_\_\_\_

## **DETAILED ACTION**

### ***Continued Examination Under 37 CFR 1.114***

1. A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application on February 29, 2008, after a final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114. Applicant's submission filed on February 4, 2008 has been entered.

### ***Status of the Claims***

2. The amendment filed February 4, 2008 has been carefully considered. Claims 20 and 26 are cancelled. Claims 1-18 are withdrawn. Claims 19, 21-25 and 27-29 are under consideration.

### ***Claim Objections***

3. Claim 19 is objected to because "and" (at the end of line 9) should be deleted. Appropriate correction is required.

### ***Claim Rejections - 35 USC § 103***

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various

claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

4. Claims 19, 22-24 and 27-29 are rejected under 35 U.S.C. 103(a) as being unpatentable over Banquy (US 4,782,096) in view of Davis et al. ("Cryogenics for Syngas Processing", *Chemical Engineering Progress*, February 1980, pages 72-79) and McNeil et al. (US 6,073,461).

Regarding claim 19, Banquy (FIGs. 1-5) discloses an apparatus comprising:  
a syngas generation system (i.e., comprising a "primary steam reforming" zone and a "secondary oxygen reforming" zone; in detail in FIG. 2) generating syngas **11** by reaction of methane **2** with steam **5** and/or an oxidant comprising oxygen **8**, (see, for example, column 6, line 19 to column 9, line 3);  
a syngas conversion system (i.e., a "synthesis loop"; in detail in FIG. 3) converting syngas **11** into higher molecular weight hydrocarbon compounds or oxygenates **14** and producing an offgas **15**, (see, for example, column 9, lines 13-46); and  
a physical separation zone for separating the various components contained in the offgas **15** produced by the syngas conversion system.

Banquy discloses that "[a]ny physical separation process can be used" in the physical separation zone and, in particular, "[t]he physical separation can... be achieved by cryogenic techniques, or distillation at low temperature, such as outlined in *Chemical Engineering Progress*, February 1980, pages 72-79 ..." to Davis et al. (see column 9, lines 55-68).

Looking to the cited publication, Davis et al. teaches a physical separation zone (see Figure 2, showing the “methane wash approach”) that separates a feed gas into a hydrogen product, a CO product, and a fuel; wherein the separation zone comprises:

a cryogenic separation system (i.e., a methane wash column) that produces the hydrogen product (i.e., in the overhead) and a first cryogenic liquid stream comprising carbon monoxide (i.e., in the bottoms); and

a cryogenic distillation column (i.e., CO/CH<sub>4</sub> fractionator) for separating carbon monoxide from the first cryogenic liquid stream to produce the CO product (i.e., in the overhead) and substantially carbon monoxide-free cryogenic liquid (i.e., in the bottoms), usable as fuel; (see also page 74, beginning of column 2, to page 75, end of column 1).

The collective teaching of Banquy and Davis et al., however, is silent as to the physical separation zone having the instantly claimed configuration of a first liquid methane wash column, a second liquid methane wash column, a nitrogen rejection column, and a cryogenic distillation column.

McNeil et al. teaches a physical separation zone (see Figure 1; generally, column 4, line 7 to column 7, line 67) that, similarly to Davis et al., separates a feed gas **1** into a hydrogen product **54**, a CO product **44**, and a fuel **53**; wherein the separation zone comprises:

a first liquid methane wash column (i.e., a column **8**, supplied with liquid methane from line **36** and pump **38**) configured to separate hydrogen from the feed gas **1** to produce a separated hydrogen product that is substantially free of carbon monoxide (i.e., leaving as overhead, via line **12** to the hydrogen rich product line **54**) and a first cryogenic liquid comprising carbon monoxide and residual hydrogen (i.e., leaving as bottoms, via line **13**), (see column 5, line 56 to column 6,

line 2; column 6, lines 54-56);

a second liquid methane wash column (i.e., a column **15**, supplied with liquid methane from line **14**) configured to separate the residual hydrogen from the first cryogenic liquid (i.e., fed by line **13**) to produce separated hydrogen usable as a fuel by-product (i.e., leaving as overhead, via line **19** to the fuel gas product line **53**) and a second cryogenic liquid comprising carbon monoxide (i.e., leaving as bottoms, via line **18**), (see column 6, lines 7-24; column 7, lines 21-67);

a nitrogen rejection column (i.e., nitrogen-separation fractionation column **22**) configured to separate nitrogen (i.e., leaving as overhead, in line **25**) from said second cryogenic liquid (i.e., fed by line **18**) to produce a third cryogenic liquid (i.e., leaving as bottoms, in line **26**), (see column 6, lines 25-37); and

a cryogenic distillation column (i.e., a methane-separation fractionation column **32**) configured to separate carbon monoxide from said third cryogenic liquid (i.e., fed by line **26**) to produce separated carbon monoxide product (i.e., leaving as overhead, in line **35** to the CO product line **44**) and a substantially carbon monoxide-free cryogenic liquid (i.e., leaving as bottoms, in line **36**), (see column 6, lines 38-53).

It would have been obvious for one of ordinary skill in the art at the time the invention was made to select the physical separation zone as taught by McNeil et al. for the physical separation zone in the apparatus of Banquy, because any physical separation process can be used, and a physical separation process employing cryogenic techniques or distillation at low temperature is specifically suggested as being suitable (see Banquy: column 9, lines 55-65). Like the cited publication to Davis et al., the physical separation zone of McNeil et al. similarly

separates a feed gas into a hydrogen product, a CO product, and a fuel. However, one having ordinary skill in the art would have been motivated to provide the physical separation zone of McNeil et al. in the apparatus of Banquy because, unlike conventional cryogenic techniques (such as Davis et al.), the separation zone of McNeil et al. further removes nitrogen contaminant from the carbon monoxide product, which is desirable for environmental and processing reasons (see McNeil et al.: column 1, lines 16-35).

Regarding claim 22, Banquy discloses (see column 9, lines 47-54, with emphasis added),

“The purge gas (stream 15) extracted from the synthesis loop is subjected to a physical separation to split it into a hydrogen-rich stream, a portion of which will be mixed with the raw synthesis gas to form the final synthesis gas, and *a residual gas stream which contains essentially methane, carbon oxides, argon, nitrogen and some hydrogen, and which can be used as fuel in the primary steam reformer.*”

Therefore, it would have been obvious for one of ordinary skill in the art at the time the invention was made to provide a conduit means for feeding separated carbon monoxide product from the physical separation zone to the syngas conversion system in the modified apparatus of Banquy, because the provision of conduit means for enabling the transport of fluids between different zones of an apparatus is conventional in the art, and such conduit means would enable the separated carbon monoxide product (i.e., the carbon oxides from the residual gas stream) to be recycled as fuel to the primary steam reformer, as specifically suggested by Banquy, above.

Regarding claim 23, Banquy further discloses that the residual gas stream contains argon (see column 9, lines 46-54). Thus, the modified apparatus of Banquy inherently comprises conduit means for removing an argon-enriched stream from a location in the region of high argon concentration in the cryogenic distillation column (i.e., via the bottoms of the methane-

Art Unit: 1797

separation fraction column 32, as taught by McNeil et al.; see column 5, lines 10-13).

Regarding claim 24, Banquy discloses (see column 9, lines 47-54, with emphasis added),

*“The purge gas (stream 15) extracted from the synthesis loop is subjected to a physical separation to split it into a hydrogen-rich stream, a portion of which will be mixed with the raw synthesis gas to form the final synthesis gas, and a residual gas stream which contains essentially methane, carbon oxides, argon, nitrogen and some hydrogen, and which can be used as fuel in the primary steam reformer.”*

Therefore, it would have been obvious for one of ordinary skill in the art at the time the invention was made to provide a conduit means for feeding separated methane product from the physical separation zone to the syngas conversion system in the modified apparatus of Banquy, because the provision of conduit means for enabling the transport of fluids between different zones of an apparatus is conventional in the art, and such conduit means would enable the methane product (i.e., methane from the residual gas stream) to be recycled as fuel to the primary steam reformer, as specifically suggested by Banquy, above.

Regarding claim 27, Banquy (see column 9, lines 47-54, with emphasis added) discloses,

*“The purge gas (stream 15) extracted from the synthesis loop is subjected to a physical separation to split it into a hydrogen-rich stream, a portion of which will be mixed with the raw synthesis gas to form the final synthesis gas, and a residual gas stream which contains essentially methane, carbon oxides, argon, nitrogen and some hydrogen, and which can be used as fuel in the primary steam reformer.”*

As seen in FIGs. 1, 4 and 5, the apparatus further comprises conduit means 12 for removing a portion of the separated hydrogen product, in order to recycle the hydrogen to the syngas conversion system (i.e., the synthesis loop) for generation of higher molecular weight hydrocarbon compounds or oxygenates 14. Please note that the recitation of a particular molar



concentration of helium within the separated hydrogen product stream is considered a process limitation that adds no further patentable weight to the apparatus claim.

Regarding claim 28, Banquy (FIG. 2) discloses that the syngas generation system comprises a partial oxidation reactor (i.e., a secondary oxygen reformer **R**; see column 7, lines 3-42) and an enhanced heat transfer reformer (i.e., an endothermic primary steam reforming reactor **F**, having catalyst containing reforming tubes heated externally by burners; see column 6, lines 43-64).

Regarding claim 29, Banquy discloses that the syngas conversion system comprises at least one FT reactor (i.e., a synthesis converter **SC**, for reacting hydrogen with carbon monoxide, carbon dioxide or mixtures of these carbon oxides to yield organic compounds, such as a hydrocarbon, a mixture of hydrocarbons, an oxygenated compound, or any mixture thereof (see FIG. 3; see column 9, lines 4-46; also, column 1, lines 10-17, lines 20-34).

5. Claim 21 is rejected under 35 U.S.C. 103(a) as being unpatentable over Banquy (US 4,782,096) in view of Davis et al. ("Cryogenics for Syngas Processing", *Chemical Engineering Progress*, February 1980, pages 72-79) and McNeil et al. (US 6,073,461), as applied to claim 19 above, and further in view of Ireland et al. (US 4,044,063).

The collective teaching of Banquy, Davis et al. and McNeil et al. is silent as to the apparatus further comprising a hydrogenation system.

Ireland et al. (FIG. 1; see, for example, column 8, line 15 to column 9, line 3) teaches a hydrogenation system (e.g., hydrotreating unit **56**; or hydrodewaxing unit **62**) for hydrogenating a fraction of the higher molecular weight hydrocarbon compounds **54**, **60** produced by a syngas conversion system (i.e., in F-T synthesis zone **4**). It would have been obvious for one of

ordinary skill in the art at the time the invention was made to further provide a hydrogenation system to the modified apparatus of Banquy, on the basis of suitability for the intended use thereof, because the provision of a hydrogenation system helps maximize the production of further liquid hydrocarbon products from the Fischer-Tropsch reaction products stream, as taught by Ireland et al.

6. Claim 25 is rejected under 35 U.S.C. 103(a) as being unpatentable over Banquy (US 4,782,096) in view of Davis et al. ("Cryogenics for Syngas Processing", *Chemical Engineering Progress*, February 1980, pages 72-79) and McNeil et al. (US 6,073,461), as applied to claim 19 above, and further in view of Keller (US 4,650,814).

Banquy discloses that "[a]ny physical separation process can be used" in the physical separation zone and, in particular, "[a]nother physical separation for this purpose is the membrane separation process, which is described in Hydrocarbon Processing May 1980 pages 115-118, and July 1980 pages 65-67," (column 9, lines 55-68). The collective teaching of Banquy, Davis et al. and Martin, however, is silent as to the provision of a membrane separation system, for removing helium from the separated hydrogen product.

Keller (FIG. 3) teaches a membrane separation system **325** for removing inert gases **344** such as helium (see column 7, lines 6-17) from a separated hydrogen product stream **330**. (see column 13, line 10 to column 14, line 34; see column 15, lines 10-36; see also FIG. 1, column 8, line 14 to column 9, line 8). It would have been obvious for one of ordinary skill in the art at the time the invention was made to further provide a membrane separation system in the modified apparatus of Banquy, on the basis of suitability for the intended use thereof, because the membrane separation system enables the generation of a high purity hydrogen stream for use as a

recycle, while minimizing the amount of inert compound build-up in the system by separating and removing any inert gases, such as helium, from the system, as taught by Keller.

***Response to Arguments***

7. Applicant's arguments with respect to claims 19, 21-25 and 27-29 have been considered but they are moot in view of the new grounds of rejection, necessitated by amendment.

***Conclusion***

Any inquiry concerning this communication or earlier communications from the examiner should be directed to JENNIFER A. LEUNG whose telephone number is (571)272-1449. The examiner can normally be reached on 9:30 am - 5:30 pm Monday through Friday.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Glenn A. Caldarola can be reached on (571) 272-1444. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/Jennifer A. Leung/  
Primary Examiner, Art Unit 1797